cation, and M. Hansen suggests that the colours of spots may eventually be differentiated by spectroscopic observations.

COLOURS AND MAGNITUDES OF DOUBLE STARS.—It is a generally accepted statement that when the magnitudes of the components of a binary-star system differ considerably their colours are also very different; similarly a slight difference in magnitude is usually accompanied by a similarity of colour.

Whilst preparing his recently published and valuable memoir on the double stars of Struve's "Mensuræ Micrometricæ" Mr. Lewis has gathered striking evidence that these statements are true, and in No. 373 of the *Observatory* he gives a table of physical pairs, from which it is seen that a gradual increase in the differences of magnitude is accompanied by constantly increasing differences of colour. A discussion of fifty double stars situated in the southern hemisphere corroborates this evidence.

ROTATION PERIOD OF JUPITER'S EQUATORIAL REGION.—In No. 4117 of the *Astronomische Nachrichten* Mr. Denning publishes the rotation periods, derived from a number of spots situated on the equatorial side of the southern equatorial belt of Jupiter, as determined by him at Bristol in the years 1898 to 1905–6 inclusive. From the tabulated statement given it is seen that the rate during 1905–6 was several seconds slower than in previous years. During 1880–3 the rotation period was from eighteen to twenty-seven seconds shorter than during 1905–6.

GEOLOGY AT THE BRITISH ASSOCIATION.

IT is only natural that the salient geological features of the district in which the association meets should in some degree influence the character of the papers presented to Section C. Yorkshire, being rich in glacial and post-glacial problems, it is not surprising that special attention was directed to the more recent episodes in the earth's history. The presidential address dealt with British drifts and the inter-glacial problem, and, after a review of all the evidence bearing on the question, Mr. Lamplugh pronounces that no proof of mild inter-Glacial epochs, or even of one such epoch, has been discovered during the examination of glaciated districts in England, Ireland, and the Isle of Man. The "Middle Glacial" sands and gravels of our islands afford no proof of mild inter-glacial conditions or of submergence. In most cases, if not in all, they represent the fluvio-glacial material derived from ice sheets. Most of the fossiliferous beds regarded as inter-glacial contain a fauna and flora compatible with cold conditions of climate, and, in the exceptional cases where a warmer climate is indicated, the relation of the deposits to the Boulder-clays is open to question.

Prof. Kendall followed the president's address with a full and comprehensive account of the general geological structure of the country round York, and dwelt specially on the glaciation of the Vale of York and the Cleveland Hills. During the meeting the members were enabled to visit the York moraine and study the glacier lakes and overflows in the eastern part of the county under the guidance of Prof. Kendall.

Other local glacial papers dealt with the Kirmington Drift deposits, recent exposures of glacial drift at Doncaster and Tickhill, post-glacial deposits at Hornsea, and the plain of marine denudation beneath the drift of Holderness.

Contributions dealing with drift problems farther afield were presented by Mr. F. W. Harmer, who continued his work on the glacial deposits of the east of England, and in another paper he applied the brilliant results obtained by Prof. Kendall in the Cleveland district to support his theory regarding "Lake Oxford" and the origin of the Goring Gap.

The Rev. W. Lower Carter applied the same results to explain a dry valley which had been a glacier-lake overflow at Cwm-Coed-y-cerig, in South Wales, and gave a detailed account of the local glaciers which formerly existed in the valleys of the Usk and Wye.

Mr. R. D. Oldham brought forward a criterion of glacial erosion of lake basins, and Prof. J. W. Gregory initiated a discussion on the problems connected with the Palæozoic glaciation of Australia, India, and South Africa. He pointed out that in Australia we have evidence of three horizons at which glacial beds occur, the Cambrian, the Carboniferous, and the Pleistocene. The Cambrian glacial beds near Adelaide range 400 miles north and south, and are interbedded with marine sediments containing a rich Cambrian fauna. Evidence of Pleistocene glaciers has only been found on the mainland near the summit of Mt. Kosciusko, the highest mountain of Australia. The Carboniferous glaciation is the most important, and presents points of the greatest interest. While in the State of Victoria there exists undoubted evidence of land ice riding over an irregular land surface, in New South Wales, West Australia, and in India the glacial beds include some that were laid down below sea-level. Beds presumably of this age are also found in South Africa, South America, and perhaps on the eastern flanks of the Urals. Prof. Gregory pointed out the inherent probability of these beds having formed part of a once continuous sheet of glacial deposits. No proof is forthcoming that they were synchronous, and in Africa and Australia the glacial evidence disappears to the north, ending about the southern tropic, and begins again in the northern hemisphere in latitude 17° 20′ N., increasing in strength northwards to Cashmere.

After a critical survey of the three theories which have been advanced to explain this problem, viz. (1) the shifting of the earth's axis (Oldham and Penck); (2) a universal refrigeration of the world due to a change in the composition of the earth's atmosphere (Arrhenius); and (3) local concentration of snowfall in consequence of a different distribution of land and water, Prof. Gregory concludes that the last is alone adequate to explain the facts.

In the discussion which followed, Prof. Edgeworth David and Mr. T. H. Holland argued in favour of Arrhenius's theory, as the cause must have been world-wide, and the phenomena could not be accounted for by local changes in topography. Mr. R. D. Oldham favoured Prof. Chamberlain's adaptation of Arrhenius's carbonic acid theory, and pointed out the analogies between the great revolutionary epochs of the earth's history, all of which are associated with glacial phenomena.

The stratigraphical papers certainly showed a bias towards the Carboniferous period. No less than five papers were read, dealing mainly with the faunal succession and zoning of beds of this age. The recent work of Dr. Wheelton Hind, Dr. Vaughan, Prof. Garwood and others, as detailed in their papers, shows great strides towards the completion of what, at one time, seemed a hopeless problem.

A discussion on the origin of the Trias was opened by Prof. Bonney and Mr. J. Lomas. Prof. Bonney considers the Bunter to be chiefly of fluviatile origin, the rivers carrying the materials having their origins in Scotland, the extreme north of Ireland, and another flowing from the south-west. The Keuper he regards as indicating the setting in of inland-sea conditions, and the Red Marl as having been deposited in a great salt lake. The physical and climatal conditions of the Trias were probably to some extent comparable with those now existing in certain of the more central parts of Asia, such as Persia or Turkestan.

Mr. Lomas compared the Triassic deposits with those now forming in desert regions. He pointed out that the dominant feature of deserts is concentration. The wind acting on loose material concentrates particles of equal size in one place, an arid climate tends to concentrate the salts brought down by rivers in solution in shallow pools held up by the irregular disposition of sand dunes, and animal and plant life is concentrated in those regions where water is more or less permanent. Taking the various divisions of the Trias, he showed that in the Bunter the pebble beds of the Midlands may be compared with those of Lancashire and Cheshire, the only difference being that the former may have been subject to the sifting action of wind, which has removed the smaller sand particles, while the latter has, in part, escaped this action, and has been augmented by material from the south. The Upper Bunter he cited as a striking example of concentration of particles of even size. The Keuper shows evidence of similar sift-

ing, and is characterised by an increasing frequency of Marl bands. These he regards as evidences of shallow lakes, and compares them with similar pools now found in the desert regions of South Africa. The muds forming the floors of these pools, both in the recent and older examples, contain Estheria, and afford impressions of foot-prints, raindrops, and desiccation cracks. The Keuper Marls he compares with the Loess of eastern Europe, and the beds of salt, gypsum, and other salts he regards as the result of evaporation in lakes.

Mr. Holland referred to certain phenomena in the Rajputana desert that supported Mr. Lomas's views with regard to the processes of concentration in arid regions, and gave evidence of the sifting action of wind in India. Similar bands of silt and mud are found filling in hollows in the Archæan rocks. He was not prepared to admit that the features of the British Trias were due only to wind action, but in the main they were due to conditions prevailing in desert regions. Prof. Cole pointed out that, in dealing with the British Trias, we must not forget the great sea eastwards and the likelihood of the establishment of a monsoon system on its margin. This might set up an intense rainy season for, say, three months in the year, followed by a dry season. Sheets of pebbles without well-defined water channels are compatible with general evidence of desiccation. Mr. R. D. Oldham showed that the only agency forming pure sands comparable with the Trias is wind. Mr. Clement Reid compared the peculiar stiff-stemmed flora of the desert with those found in the Trias.

The papers dealing with palæontology were more than usually interesting. Mr. C. G. Danford exhibited and described a fine series of ammonites from Speeton. Mr. A. C. Seward dealt with the Jurassic flora of Yorkshire, and Dr. H. Woodward, in describing a wonderful collection of arthropods from the Coal-measures at Sparth Bottoms, showed what an enthusiastic band of collectors can do, when work is taken in hand in the spirit which characterises the Rochdale geologists.

The report on the fauna and flora of the Trias included an important paper by Dr. A. Smith Woodward on *Rhynchosaurus articeps*, and Mr. H. C. Beasley and Mr. Lomas described the great finds of Triassic foot-prints which have recently been discovered at Storeton, in Cheshire, and Hollington, in Staffordshire.

In petrology and mineralogy great interest was shown in the announcement by Prof. Edgeworth David that diamonds had been found embedded in the matrix near Inverell, New South Wales.

Mr. T. H. Holland demonstrated the peculiar properties of a variety of sodalite from Rajputana. When freshly broken it has a bright carmine colour, which changes to dull grey on being exposed to light. The carmine colour returns when the specimen is kept in the dark. Prof. H. S. Reynolds dealt with the igneous rocks in the district south-west of Dolgelly, and described the occurrence of a picrite from the eastern Mendips.

In general geology Mr. J. Parkinson gave an interesting account of the post-Cretaceous geology of Southern Nigeria, Prof. Cole outlined a scheme of geology suited to agricultural scholars, and Prof. J. Milne discussed certain earthquake relationships.

While the time of the section was fully taken up by the consideration of the above subjects, no less than thirty-seven papers dealing with strictly geological matters were read in other sections. J. L.

ZOOLOGY AT THE BRITISH ASSOCIATION.

THE large attendance at many of the meetings of Section D was sufficient evidence of the general interest of the programme, which included discussions upon the Tanganyika problem, the nature of fertilisation, spicule formation in sponges, the bearing of scientific marine investigations on practical fishery problems, and a number of papers on special subjects, only a few of which can be noticed here.

The Tanganyika Problem.

The discussion on the Tanganyika problem was opened by Mr. J. E. S. Moore, who dealt, first, with the characters of fresh-water faunas in general, pointing out the wide distribution of many fresh-water organisms over the land surfaces of the world. He held that the difficulties in the way of the migration of these animals were so great that their wide distribution could not be attributed solely to such migration. He suggested that in all probability the sea is becoming more salt, and that this change may have been concerned in the production and separation of marine and fresh-water faunas. Whatever the actual cause of separation, as the general fresh-water fauna of the globe possessed certain archaic characters it would be convenient to name this the primary fresh-water fauna. To this primary fauna there are added in many places, *e.g.* in the Caspian Sea, animals which have, from their structure and affinities, been obviously derived from the sea, and have an origin independent of that of the fresh-water fauna of the region in which they occur. To these animals Mr. Moore applied the name halolimnic. There are in Tanganyika a number of animals peculiar to that lake, and regarded by Mr. Moore as halolimnic. The mollusca of the lake are represented by certain ordinary fresh-water forms, but, in addition, there are several not closely related to any recognised fresh-water type, nor does their anatomy suggest that they have been evolved from any African fresh-water form; there are four Polyzoa, only one of which is phylactolæmatous, and it may be inferred that the other three are derived from marine forms, while the occurrence of a medusa is also suggestive in this connection. There are three possible explanations of these faunistic peculiarities:—(1) that they are due to direct modifications of the general African fresh-water fauna; (2) that they are constituted by the presence in the lake of the remains of an extinct fresh-water fauna; (3) that they are due to the presence of halolimnic elements. Mr. Moore regarded the last as the correct explanation, and referred to the similarity of the shells of certain Tanganyika gastropods to those common in Jurassic seas. The evidence points to Tanganyika having been isolated a long time from the sea.

Mr. W. A. Cunnington gave a brief account of the third Tanganyika expedition, from which he had recently returned. 115 fishes are now recorded from the lake, 102 of which occur nowhere else. Twelve species of prawns (of which only one has been found elsewhere) are all specialised in the direction of reduction of gills, and the four species of crabs are all endemic. These facts are probably to be explained by the long isolation of the lake. It is curious that no Cladocera were met with in Tanganyika, though they are abundant in Victoria Nyanza and Lake Nyassa.

Prof. J. W. Gregory considered that there are no evidences of marine rocks in the plateau of equatorial Africa, though it is evident that the plateau is of great antiquity. The idea of the occurrence of the sea in the Tanganyika valley should be abandoned. He suggested that the "halolimnic" fauna is rather to be explained as a part of an ancient lake fauna at one time widely distributed over Africa, but now surviving only in Tanganyika.

Prof. Pelseneer pointed out that the external resemblances of shells are often illusory, and the results to which they lead quite uncertain, therefore only the study and comparison of the internal organisation of the molluscs can throw light on the question at issue. Messrs. Moore and Digby have suggested that some of the Tanganyika molluscs have affinities to certain marine forms, Chytra being related to Hipponyx and Capulus, Spekia to Lamellaria, and Edgaria (=Nassopsis) to the Architænioglossa; but Prof. Pelseneer held that there are really no affinities, in the usual sense of the word, between these forms, but only distant resemblances, such as are common to all the Tænioglossa, to which group these "halolimnic" forms belong. Nor do they present archaic characters to a greater extent than other fresh-water genera not "halolimnic," such as Ampullaria and Paludina. Prof. Pelseneer concluded that all the "halolimnic" gastropods belong to the family Melaniidæ or to closely related types, as is shown by their radulæ, otocysts, &c., and by special details of their biology—their fresh-water habitat and viviparity. The study of two genera (Giraudia and Lavigeria) the organisation of which has only just been investigated supports this conclusion. Both have in their otocysts multiple otoliths, one otolith being much larger